CLAIMS

What is claimed is:

1. A method of measuring changes in optical properties of layered materials comprising:

directing an incident wave toward the layered materials under conditions that will produce a propagating surface mode in the layered materials, wherein the layered materials have an index of refraction;

measuring an intensity distribution within a transverse beam profile of a total reflected beam;

modifying the index of refraction of the layered materials;

re-measuring the intensity distribution within a transverse beam profile of the total reflected beam;

comparing the measured intensity distributions to detect differences in the index of refraction in the layered materials.

2. The method defined in Claim 1 further comprising tuning an angle of the incident wave to an optimum angle that maximizes an amplitude of the surface mode.

3. The method defined in Claim 1 wherein intensity distribution data corresponding to each of the transverse intensity distributions is analyzed, such that the smallest changes in the transverse beam profile are detected.

4. The method defined in Claim 1 wherein the intensity distribution within the transverse beam profile of the total reflected beam is measured as a function of transverse beam position.

5. The method defined in Claim 4 wherein the total reflected beam is sensed by an optical detector.

6. The method defined in Claim 1 wherein the directed incident wave is a well-collimated beam.

7. The method defined in Claim 6 wherein the incident beam has a diameter of not more than 2.1 millimeters at full-width half-maximum.

8. The method defined in Claim 7 wherein the beam diameter is between 0.05 millimeters and 1 millimeter at full-width half-maximum.

9. The method defined in Claim 5 wherein the transverse beam profile is measured parallel to the surface of the optical detector.

10. The method defined in Claim 1 wherein the incident wave comprises electromagnetic radiation whereby the radiation is introduced in such a way that the radiation excites a surface mode at one of a plurality of surfaces comprising the layered materials.

11. The method defined in Claim 1 wherein the layered materials comprise a plurality of layers.

12. The method defined in Claim 11 wherein a first layer is a dielectric medium.

13. The method defined in Claim 12 wherein a second layer is a metal surface.

14. The method defined in Claim 13 wherein a third layer is an organic bonding layer between the metal surface and a fourth layer.

15. The method defined in Claim 14 wherein the third layer further comprises antigen molecules.

16. The method defined in Claim 15 wherein the index of refraction of the layered materials is modified by introducing a fourth layer into contact with the layered materials.

17. The method defined in Claim 16 wherein the fourth layer is an organic layer further comprising antibody molecules.

18. A method of measuring changes in optical properties of layered materials comprising:

directing an incident wave toward the layered materials under conditions that will produce a waveguide mode in the layered materials, wherein the layered materials have an index of refraction;

measuring an intensity distribution within a transverse beam profile of a total reflected beam;

modifying the index of refraction of the layered materials;

re-measuring the intensity distribution within a transverse beam profile of the total reflected beam;

comparing the measured intensities to detect differences in the index of refraction in the layered materials.

19. The method defined in Claim 18 further comprising tuning an angle of the incident wave to an optimum angle that maximizes an amplitude of the waveguide mode.

20. The method defined in Claim 19 wherein the incident wave is directed towards the layered materials at the optimum angle.

21. The method defined in Claim 20 wherein the intensity distribution within the transverse beam profile of the total reflected beam is measured as a function of transverse beam position.

22. The method defined in Claim 21 wherein the total reflected beam is sensed by an optical detector.

23. The method defined in Claim 22 wherein the transverse beam profile is measured parallel to the surface of the optical detector.

24. The method defined in Claim 18 wherein the directed incident wave is a well-collimated beam.

25. The method defined in Claim 24 wherein the incident well-collimated beam has a diameter of not more than 2.1 millimeters at full-width half-maximum.

26. The method defined in Claim 25 wherein the beam diameter is between 0.05 millimeters and 1 millimeter at full-width half-maximum.

27. The method defined in Claim 18 wherein the layered materials comprise a plurality of layers.

28. The method defined in Claim 27 wherein a first layer is a wave-guide region.

29. The method defined in Claim 28 wherein the second layer is an organic bonding layer between the wave-guide region and the third layer.

30. The method defined in Claim 29 wherein the third layer is an organic layer further comprising antigen molecules.

31. The method defined in Claim 30 wherein the index of refraction of the layered materials is modified by introducing a fourth layer into contact with the layered materials.

32. The method defined in Claim 31 wherein the fourth layer is an organic layer further comprising antibody molecules.

33. The method defined in Claim 32 wherein the waveguide region of the layered materials is capable of supporting the waveguide mode.